

REMARKS

By this amendment, applicants have amended claims 1, 3 and 5 to recite that the etching method is for forming a trench having a prescribed depth in an organic insulating film without using an etching stopper layer. See, e.g., page 20, line 25 to page 21, line 3 of applicants' specification. Applicants have also added claims 10 - 23 to further define their invention. See, e.g., Figures 3 and 4(a)-(f) and the description thereof in applicants' specification.

Applicants note the Examiner's comments regarding the Information Disclosure Statement filed February 25, 2002, in numbered section 1 of the office action, and thank the Examiner for listing WO 01/15213 (incorrectly listed as WO 01/15216 on the PTO-892) and JP 2000-252359. While it is submitted the list provided February 25, 2002 complied with 37 CFR 1.98(a)(1), which merely requires a list but does not require any particular form, it is noted that the documents have been considered by the Examiner and listed on the PTO-892; therefore, the issue of whether or not the list provided February 25, 2002 complies with 37 CFR 1.98(a)(1) is moot. Applicants request, however, that the Examiner correct the PTO-892 to reflect the correct publication number of WO 01/15213.

Claims 1 - 7 stand rejected under 35 USC 103(a) as being unpatentable over Japanese Patent Application Publication No. 2000-252359 (Fukazawa) in view of Japanese Patent Application Publication No. 8-330278 (Nakagawa). Applicants traverse this rejection and request reconsideration thereof.

The present invention relates to a method for etching an organic insulating film while preventing microtrenching, in which an organic insulating film having no etching stopper layer is partway (partially) etched up to a prescribed depth (film thickness) in a film thickness direction.

In the case where etching is stopped in, e.g., the middle of the thickness direction of the organic insulating film, as in the present invention, it has to be carried out so as not to generate microtrenching, i.e., so as not to generate a local etching velocity difference. According to the present invention, a light emission spectral intensity ratio between cyan molecule and hydrogen atom in the plasma is measured, and the measured value is kept at a value not exceeding a prescribed value in order to suppress microtrenching.

In contrast, Fukazawa discloses an etching method in which an insulating film including an organic dielectric film is etched and worked quickly without lowering a throughout and in which the insulating film is etched until the wiring layer is exposed.

In Fukazawa, it is sufficient to completely etch the organic insulating layer all the way through the thickness direction, the organic insulating film being selectively etched between the first wiring layer thereunder. Thus, the issue of microtrenching in the organic insulating layer never comes into question. Additionally, Fukazawa does not suggest that a light emission spectral intensity ratio between hydrogen atoms and cyan molecules in the plasma can be controlled for avoiding microtrenching.

Thus, the present invention is not disclosed and would not have been suggested by Fukazawa in which etching is not stopped in, e.g., the middle of the film. That is, Fukazawa does not suggest an etching method for forming a trench having a prescribed depth in an organic insulating film without using an etching stopper layer, as presently claimed.

Nakagawa discloses that plasma production conditions are adjusted to make a ratio of the intensity of light emission from CF_2 molecules in plasma and the intensity of light emission from F atoms constant, in order to realize good

reproducibility of selectivity of etching velocity for a long period. Thus, Nakagawa does not disclose the feature of the present invention that an etching process is carried out while keeping the measured value of light emission spectral intensity ratio of hydrogen atoms to cyan molecules at a value not exceeding a prescribed value so as not to generate microtrenching.

The CN/H ratio is especially important for inhibiting a local etching velocity different (i.e., subtrenching). Applicants have found that a ratio 1 or less is advantageous for keeping the etching velocity difference within a prescribed value.

It is submitted neither Fukazawa nor Nakagawa would have suggested an etching method for forming a trench having a prescribed depth in an organic insulating film without using an etching stopper layer, including carrying out the etching process so that the measured value of light emission spectral intensity ratio between cyan molecule and hydrogen atom in the plasma does not exceed a prescribed value. Accordingly, claims 1 - 7 are patentable over the proposed combination of Fukazawa and Nakagawa.

Claims 8 and 9 stand rejected under 35 USC 103(a) as being unpatentable over Fukazawa in view of Nakagawa and further in view of United States Patent No. 6,080,529 to Ye et al. Applicants traverse this rejection and request reconsideration thereof.

The patent to Ye et al discloses a method of patterning a semiconductor device, the Examiner relying on the disclosure at column 7, lines 24 - 29 of Ye et al which discloses the use of a hydrocarbon-based plasma optionally including a lesser amount of a component selected from the group consisting of ammonia, hydrogen, nitrogen, and combinations thereof. While the Examiner alleges that it would have been obvious to use hydrogen and ammonia or nitrogen in the process of Fukazawa,

it is submitted even the combined teachings would not have suggested a mixing ratio of hydrogen gas to ammonia gas of 10 or more. In this regard, the Examiner's assertion that nitrogen can be used as an inert gas is inconsistent with the teachings of Fukazawa. Moreover, nothing in Ye et al remedies any of the basic deficiencies noted above with respect to Fukazawa and Nakagawa. Accordingly, claims 8 and 9 are patentable over the proposed combination of references.

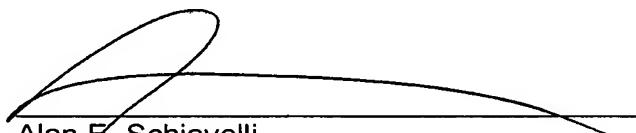
Applicants note the Examiner has cited a number of documents as being pertinent to applicants' disclosure. However, since these documents were not applied in rejecting claims formerly in the application, further discussion of these documents is deemed unnecessary.

In view of the foregoing amendments and remarks, favorable reconsideration and allowance of all of the claims now in the application are requested.

To the extent necessary, applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (Case: 500.41254X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

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